INSTRUCTIONS

CLASS JL AND JN TELEMETER RECEIVERS

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The Class J Telemeter Receiver functions as a part of an a-c voltage ratio circuit, which uses the null-balance principle for transmitting position. The circuit is applicable to variables which can be expressed mechanically as the position of a core in a movable core type of transmitter. The Receiver converts electrical signals of core position to rotation of a cam. The cam positions a drive lever which may be used to operate recording, indicating, integrating, and control devices in the Type WM5□ Recorder or Indicator.

CROSS REFERENCES

Instrument or Equipment	Instruction Section
Type KM5□ or WM5□ Recorder or Indicator	E12-3
Solid-State A-C Amplifier Part No. 6618760-□	E12-44
Electric Receiver for Type WM5□ Recorder or Indicator (Assembly and Components)	E12-42

FORM IE12-19-866

NOTE 1 - FOR TRANSMITTER WITH TERMINAL BLOCK CONNECT EXTERNAL WIRES AS SHOWN. FOR TRANSMITTER WITHOUT TERMINAL BLOCK CONNECT TO MARKED FLEXIBLE CONNECTING LEADWIRE (3') SUPPLIED WITH THE TRANSMITTER.

NOTE 2 - CONNECTIONS FOR TRANSMITTERS TYPES KP, LU, LH WITHOUT TERMINAL BLOCK. REFER TO FIG. "A"

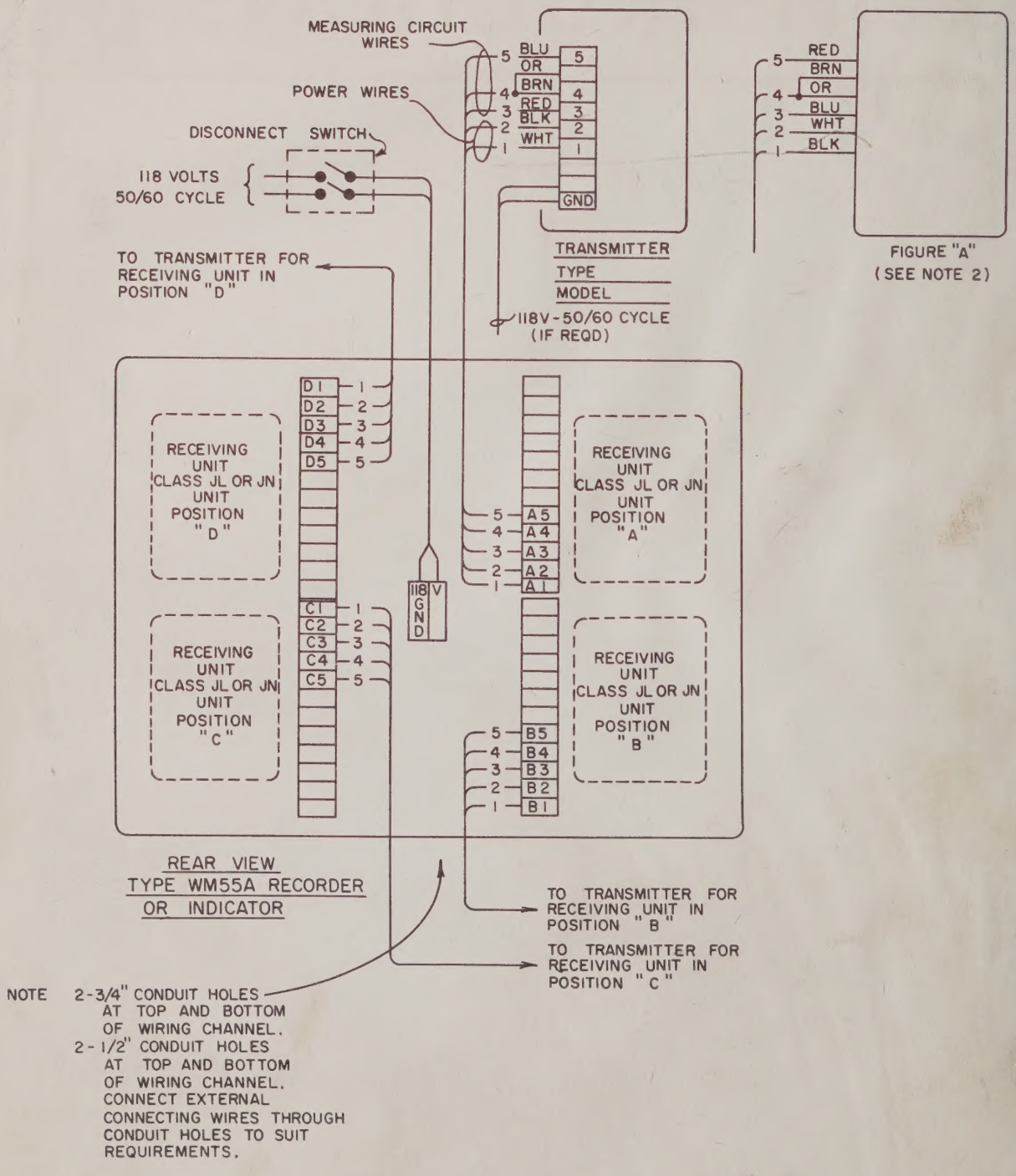

FIGURE 1 - External Connection Diagram

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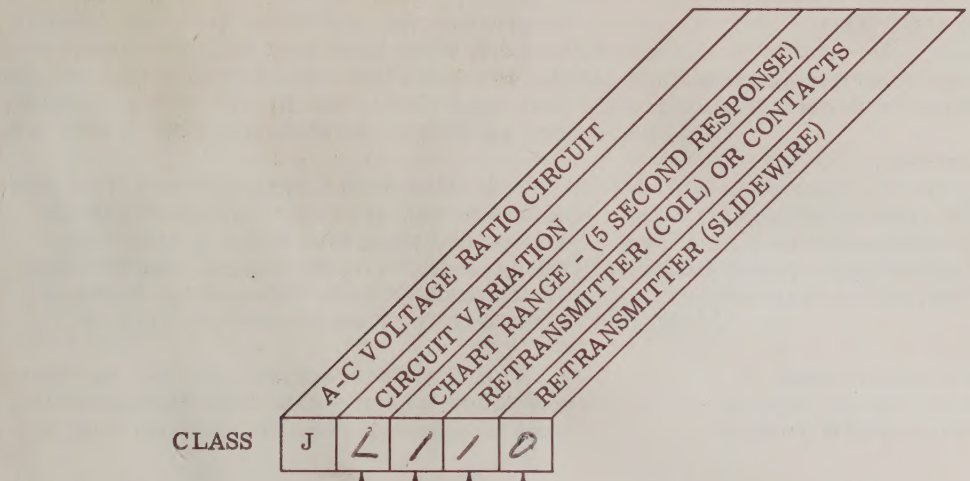
EXPLANATION OF NOMENCLATURE



L	Linear A-C Input Signal
N	Non-Linear A-C Input Signal

	Recording Range
0	*Non Recording
1	0-100% Chart Range

0	None
1	100 Ohm Slidewire
2	2000 Ohm Slidewire
3	20 Ohm Slidewire
5	500 Ohm Center Tap SW.

Not Available in Class JN

	0	No Contacts or MCT
	1	High or Low-Single Switch
	2	High and Low-Two Switches
Δ	5	Single Output-50% Null
Δ	6	Single Output-0% Null
Δ	7	Double Output-50% Null

Δ- % Null = Position of stroke at electrical null

* - Non recording unit has ring scale on slidewire disc for calibration and readout

An "X" in any nomenclature position indicates that in this respect the unit is special. An "X" as a suffix to the nomenclature indicates that the instrument includes some special feature not covered by the nomenclature.

INSTALLATION

External Connections and Wiring

The external wiring connection diagram for Class JL and JN circuits is shown in Figure 1.

1. Power Requirements

118 volts, 50/60 cycle power supply: 107 volts minimum, 127 volts maximum. ±2 cycles maximum variation in frequency. Power load: 16 VA at .91 power factor (including transmitter MCT).

2. Connecting Wire Requirements

a. Number of Wires and Wire Size: Measuring circuit -- 3 per Receiver. Power supply - 2 per Receiver. Maximum resistance per line should be limited to 10 ohms. For distance up to 2500 feet No. 16 AWG is suitable. No. 14 AWG is suitable from 2500 to 4000 feet.

b. Maximum Length of Wires: Two miles. However, this type of circuit usually is not economical when wire length greater than 3000 feet is required. If more than 3000 feet is required, consult Bailey Meter Company for alternate arrangements.

c. For the measuring circuit, use wires with a low leakage, good dielectric insulation, such as polyvinyl chloride, polyethylene, or

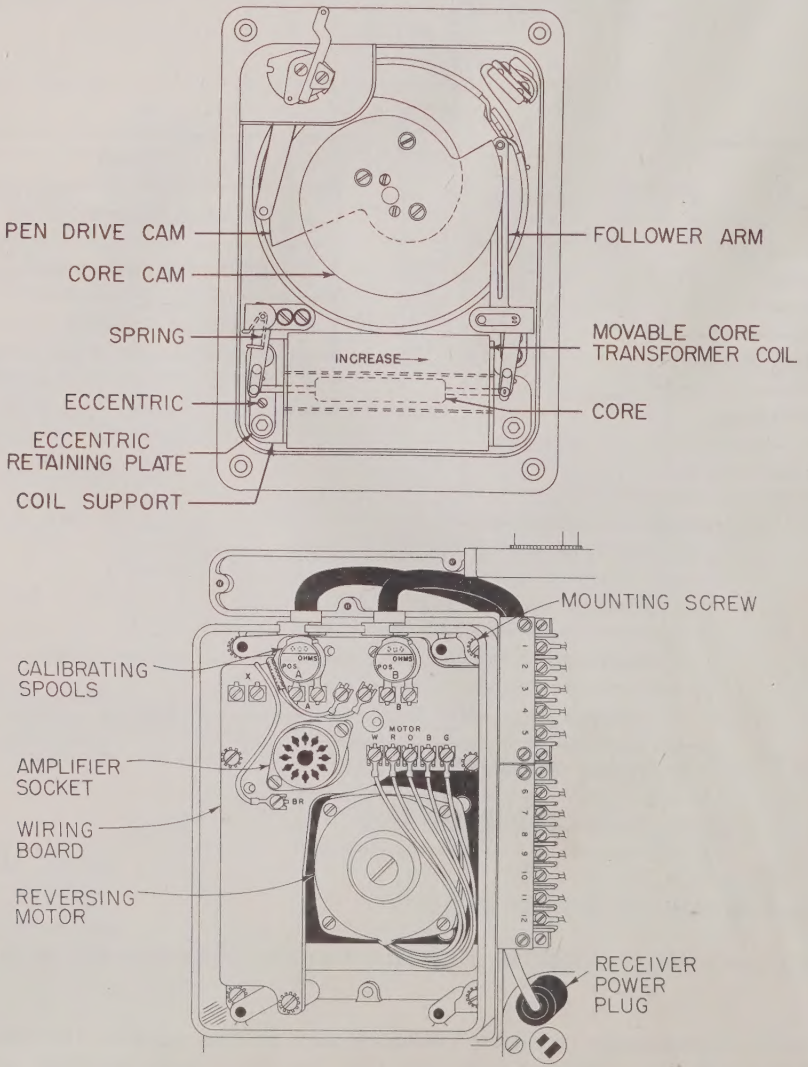


FIGURE 2 - Front and Rear View of Receiver

*HIGH LEVEL	**LOW LEVEL	Maximum Recommended Distance that Measuring Circuit Wires may be run in Common Cable
2	0	3000 feet
3 or more	0	2000 feet
1	1 or more	200 feet
2	1 or more	100 feet

Whenever low level measuring circuits are Class Q for temperature range spans of 300F or greater, the maximum recommended distance may be doubled.

*High Level Circuit: Measuring circuit operating at potential of several volts, such as Class J a-c ratio circuit or Class B voltage balance circuit.

**Low Level Circuit: Measuring circuit operating at potential in order of millivolts, such as Class Q Wheatstone Bridge circuits, Class G gas analysis circuit, or Class G smoke density or particle concentration circuit.

TABLE A - Wire Length Recommendations for Multiple Measuring Circuits

Teflon. Insulation wall thickness must be suitable for at least 300 volt rated operation.

d. To prevent interference from adjacent power wiring or other electrical devices, measuring circuit wires should be run in metallic shielded cable or conduit. For wire length 600 feet or less, measuring circuit and power supply wires may be run in same cable with overall metallic shield. If the wire length is greater than 600 feet, the measuring circuit wire must be independently shielded from the power supply wires. Shield must be grounded at Receiver end. In any case, if the measuring circuit wires are run adjacent to power or control wiring carrying current in excess of 35 amperes, the shield must be of magnetic material.

e. Measuring circuits to be run together with other Bailey Meter Company a-c measuring circuits can be combined in a common shielded cable or conduit per the distances listed in Table A.

Transmitter - Movable Core Transformer

The standard (Model K, P, or H) movable core transformer coils are constructed to withstand transmitter body temperatures up to 140F during operation.

Under certain conditions the movable core and armature tube are in contact with the fluid being measured. Under these conditions the standard movable core transformers will operate satisfactorily at fluid temperatures up to 200F.

Receivers

The Class J Receiver unit can be mounted in the Type WM5□ Recorder or Indicator in any of its four component positions -- A, B, C or D -- as shown in Figure 1. The unit, which includes the Receiver wiring board, electronic amplifier, and motor driven slidewire unit, is secured to the rear of the Recorder or Indicator Case by four mounting screws, which are accessible when the amplifier cover is removed (see Figure 2).

External electrical connections, which also are shown in Figure 2, are made to the measuring and auxiliary terminal blocks adjacent to the Receiver, within the wiring channel on the rear of the Recorder or Indicator.

An adjustable link transmits the motion of the Receiver drive arm to the pen or pointer yoke. The Receiver requires a different link for each Recorder or Indicator case position. Each link is stamped with the letter of the position for which it is suitable. The method for connecting and disconnecting adjustable links is illustrated under "Installation of Additional Components" in Instruction Section E12-3, Type KM5□ or WM5□ Recorder or Indicator.

If the Class J Receiver is received already installed in the Recorder or Indicator:

1. Install Recorder or Indicator as outlined in Instruction Section E12-3 under "Installation". Place pens in service at this time.

2. Assembly has been factory calibrated and should require no further adjustment or calibration.

3. Test power source for correct voltage and frequency.

4. Make external electrical connections to Receiver (Figure 1).

5. Turn on Recorder or Indicator. Allow one minute for amplifier warm-up. If Receiver does not operate, follow fault correction procedure outlined under "Maintenance", page 10.

6. Set amplifier sensitivity adjustment, as described in Solid-State A-C Amplifier Instruction Section E12-44.

If the Receiver is being added to a Type WM5□ Recorder or Indicator, follow the instruction sheet that was shipped with the Receiver kit.

If the Receiver is being changed from one component position to another, use the adjustable link and pen or pointer assembly that are appropriate to the new position. If the assembly for the new component position is not already in service, install the correct assembly. For a Recorder, start the pen as described in Instruction Section E12-3 under "Installation of Additional Components". Attach the adjustable link to the Receiver drive arm leg that is stamped with the appropriate Recorder or Indicator case position letter.

DESCRIPTION OF OPERATION

The basic Class J telemeter circuit consists of a transmitter unit and a Receiver, as illustrated in Figure 3. Detailed diagrams of specific circuit applications are shown in Figures 5 and 6.

Circuit Description

In the circuit illustrated in Figure 3, an a-c ratio bridge is formed by the two secondary windings of the movable core transformer (MCT) and the resistances on each side of the slidewire contact in the Receiver unit. The bridge is balanced when voltage ratio E2/E1 is equal to the ratio of the voltage drops across the resistances on each side of the slidewire contact. At bridge balance, the bridge unbalance voltage, eb, equals zero.

A change in the measured variable moves the core of the transmitter MCT and unbalances the bridge. The amplifier and motor control unit immediately senses any bridge unbalance voltage, and applies a corrective signal to the slidewire reversing motor to rotate the slidewire so that the circuit is restored to a balanced condition. When proper values of A, B, and SW are chosen, the position of the slidewire accurately reflects the transmitter MCT core position. Since a-c voltage is supplied

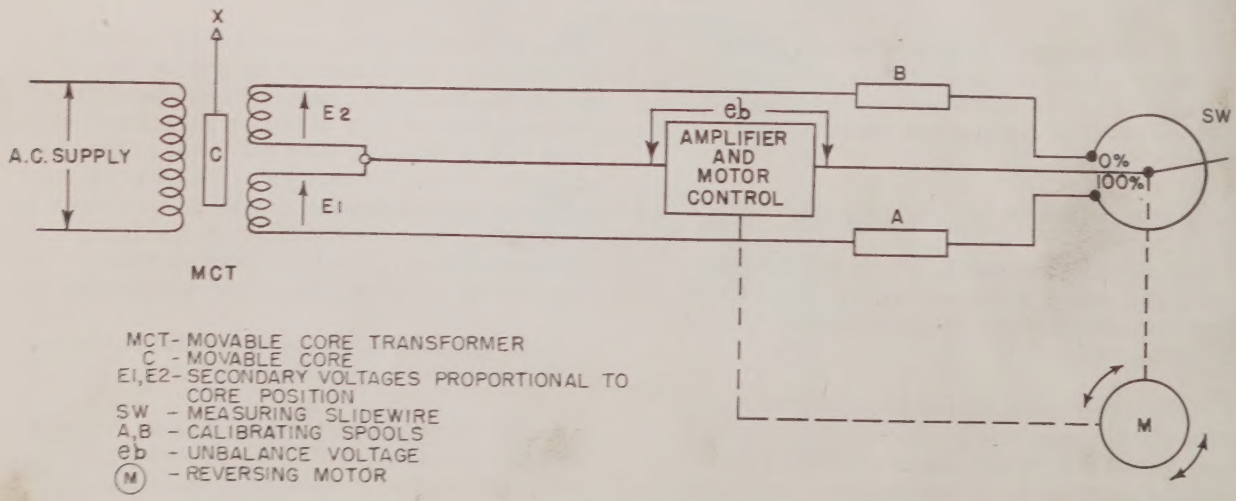


FIGURE 3 - Simplified Schematic of Class J Circuit

to the ratio bridge circuit by the transformer action of the MCT, direction of motor rotation to rebalance the bridge is determined by the phase of the unbalance voltage, eb. Instruction Section E12-44 explains the method of amplification and motor control in detail.

Transmitter Unit

The transmitter contains a movable core transformer (MCT), the core of which is positioned by a Ledoux bell, Bourdon tube, float, bellows, or other measuring unit, depending on the variable to be measured. For each specific application of the Class J circuit, the type of transmitter that is used is described in another section of this instruction book.

Operation of Movable Core Transformer:

The movable core transformer windings, shown in Figure 4, consist of a primary winding, which supplies the exciting magnetic flux, and two secondary windings placed concentric with the primary. The position of the movable core determines the magnetic flux linkage between the primary winding and the secondary windings, as illustrated by views A, B, and C of Figure 4. The voltage induced in each secondary coil is proportional to the displacement of the core from its center position.

The terminal connections to the MCT are as follows (see Figure 5 or 6):

1 - 2 -- Primary winding. Primary voltage is 45 volts a-c.

3 - 4 -- Secondary winding producing voltage E1.

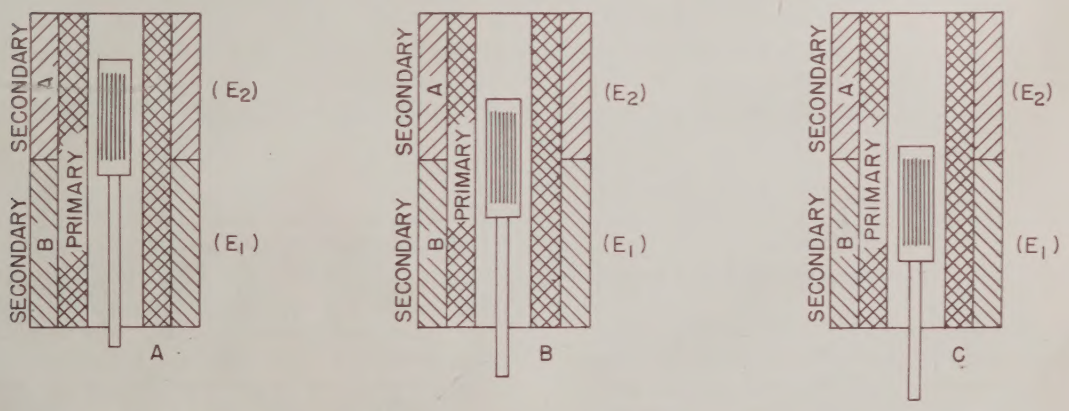
4A - 5 -- Secondary winding producing voltage E2.

Receiver Unit

The Receiver unit consist of the following components of the Class J circuit:

measuring circuit components, including calibrating spools and slidewire, interconnected on the wiring board;
reversing motor;
electronic amplifier (and motor control) unit.

A change in the transmitter MCT secondary voltages E1 and E2, resulting from a change in measured variable, creates an unbalance of the ratio bridge measuring circuit. The unbalance



(A) CORE POSITION ABOVE CENTER. FLUX LINKING SECONDARY A IS GREATER THAN FLUX LINKING SECONDARY B; AND E2 IS GREATER THAN E1. (B) CORE IS AT CENTER. EQUAL FLUX LINKAGE; E2 AND E1 ARE EQUAL (C) CORE POSITION BELOW CENTER. FLUX LINKING SECONDARY B IS GREATER THAN FLUX LINKING SECONDARY A; E1 IS GREATER THAN E2.

FIGURE 4 - Movable Core Transformer

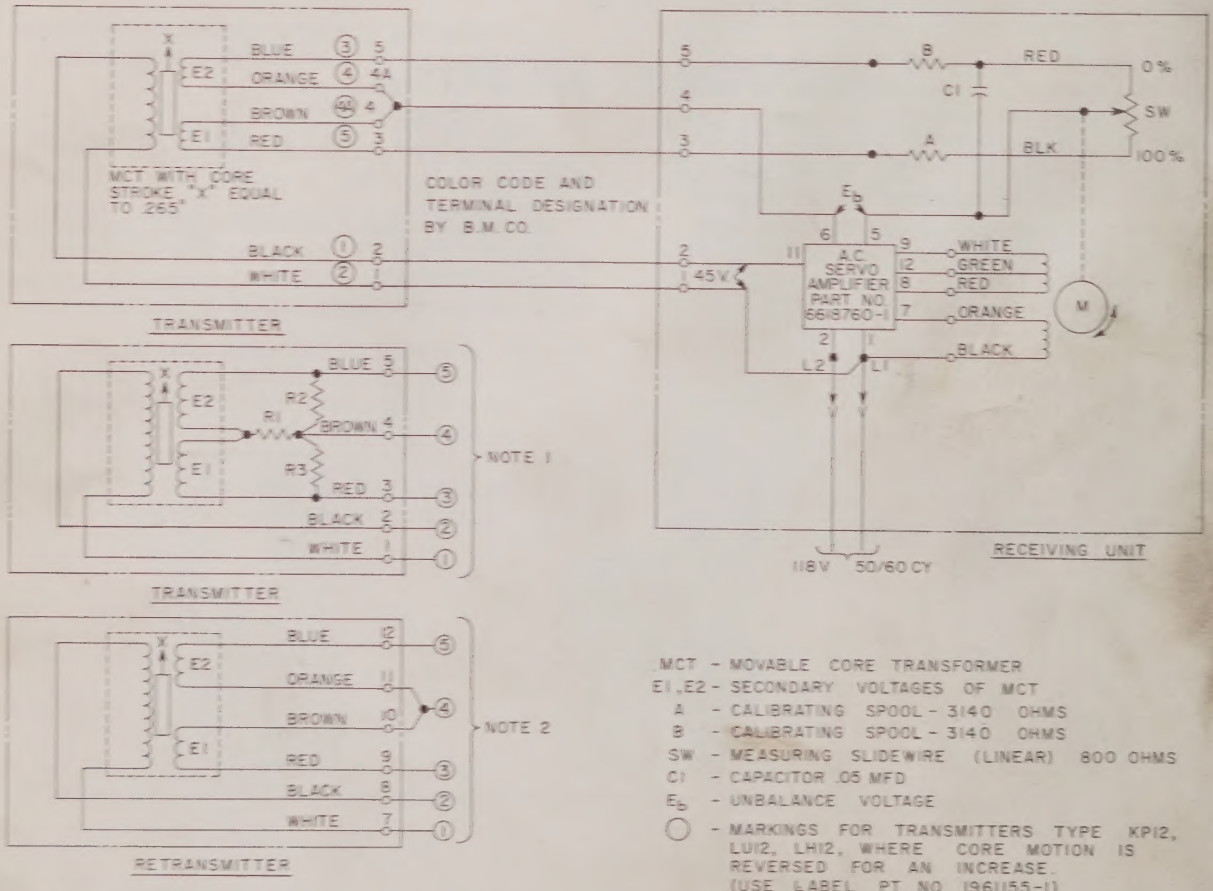
voltage, eb, is amplified by the amplifier section and applied to the motor control section, which operates the reversing motor to reposition the slidewire and rebalance the bridge. The repositioning action is continuous, so that the slidewire follows any movement of the MCT core. When the bridge is balanced, the amplifier input, eb, is zero, and the reversing motor stops. A cam and follower arrangement, operated by the slidewire motor, positions a drive arm, which drives the recording pen or indicating pointer.

There are two basic variations of Class J measuring circuits, which provide for linear and non-linear (square root) interpretations of the measured variable.

Class JL Circuit (Figure 5)

This variation includes a linear slidewire (with equal increments of resistance change for equal increments of slidewire rotation) and a linear rise cam. The transmitter is calibrated so that the core of the MCT is at the center of the coil when the variable is at 50% of its measured range. Thus the core stroke over full range has equal travel above and below MCT center.

NOTE: The center of the MCT is defined as its electrical center, where the voltages induced in the two secondary windings are equal. Normally, it is very close to the dimensional center. Refer to Figure 7.

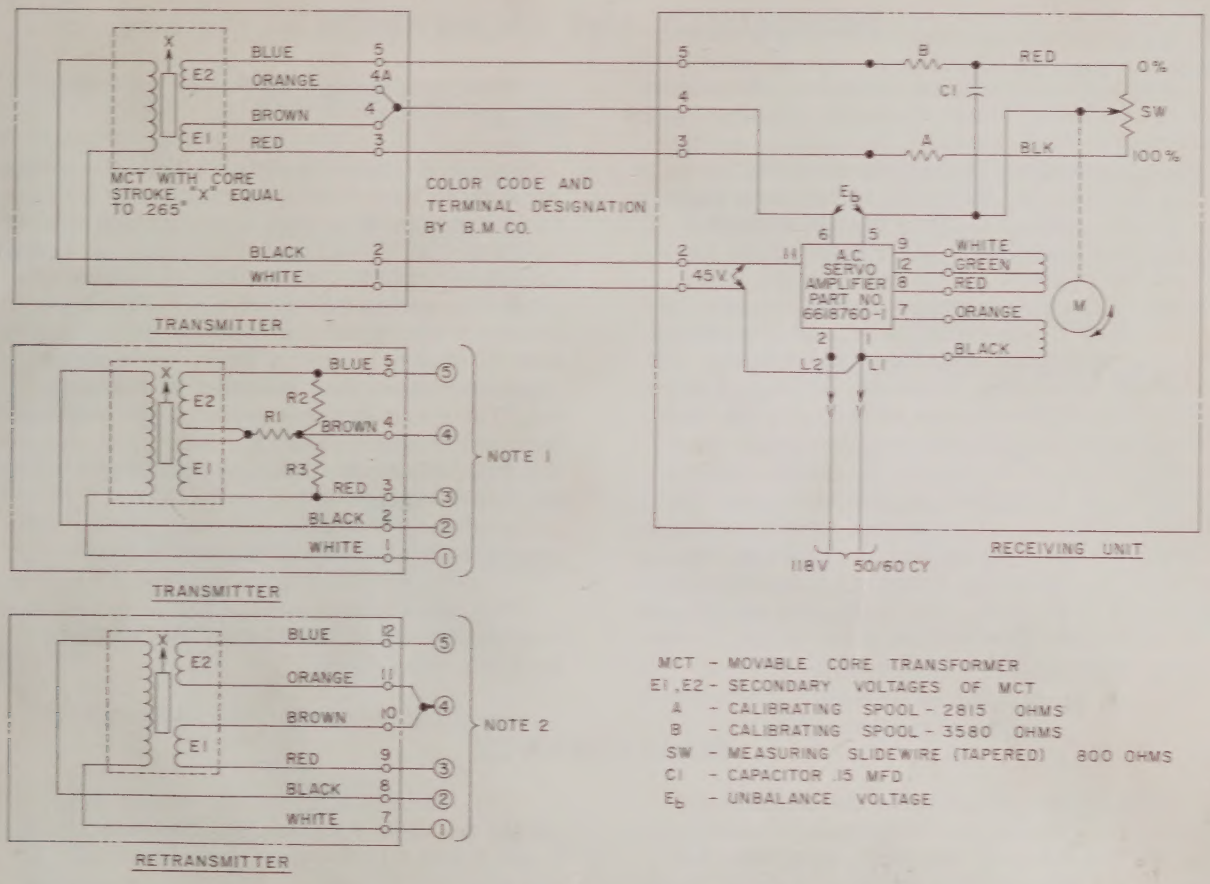


MCT - MOVABLE CORE TRANSFORMER
E1, E2 - SECONDARY VOLTAGES OF MCT
A - CALIBRATING SPOOL - 3140 OHMS
B - CALIBRATING SPOOL - 3140 OHMS
SW - MEASURING SLIDEWIRE (LINEAR) 800 OHMS
C1 - CAPACITOR .05 MFD
E_b - UNBALANCE VOLTAGE
◯ - MARKINGS FOR TRANSMITTERS TYPE KPI2, LUI2, LHI2, WHERE CORE MOTION IS REVERSED FOR AN INCREASE. (USE LABEL PT. NO. 196II55-1)

NOTE 1
TRANSMITTER WITH CORE STROKE "x" GREATER THAN .265" REQUIRES CALIBRATING SPOOLS R_1, R_2, AND R_3, AS SHOWN, AND ARE MOUNTED ON MCT. (R_1 - RANGE SPOOL (ADJUSTED SO MCT OUTPUT VOLTAGE RATIO IS STANDARD AT CALIBRATION.) R_2, R_3, - 3000 OHMS.

NOTE 2
MCT TRANSMITTER IN WM RECORDER. CORE STROKE "X" ADJUSTED FOR .265"

FIGURE 5 - Schematic Wiring Diagram of Class JL Circuit



MCT - MOVABLE CORE TRANSFORMER
E1, E2 - SECONDARY VOLTAGES OF MCT
A - CALIBRATING SPOOL - 2815 OHMS
B - CALIBRATING SPOOL - 3580 OHMS
SW - MEASURING SLIDEWIRE (TAPERED) 800 OHMS
C1 - CAPACITOR .15 MFD
E_b - UNBALANCE VOLTAGE

NOTE 1
TRANSMITTER WITH CORE STROKE "X" GREATER THAN .265" REQUIRES CALIBRATING SPOOLS R_1, R_2, AND R_3, AS SHOWN, AND ARE MOUNTED ON MCT. (R_1 - RANGE SPOOL (ADJUSTED SO MCT OUTPUT VOLTAGE RATIO IS STANDARD AT CALIBRATION.) R_2, R_3, - 3000 OHMS.

NOTE 2
MCT TRANSMITTER IN WM RECORDER CORE STROKE "X" ADJUSTED FOR .265".

FIGURE 6 - Schematic Wiring Diagram of Class JN Circuit

Class JN Circuit (Figure 6)

This variation includes a tapered slidewire (with unequal increments of resistance change for equal increments of slidewire rotation) and a non-linear rise cam, the combination of which extracts the square root of the measured variable. It is applied to the measurement of flow when transmitter MCT core motion is in terms of differential pressure. In order that flow may be recorded on a linear scale, square root extraction by the tapered slidewire - cam combination is necessary.

In Class JN circuits, the transmitter is calibrated so that the core is in the center of the MCT (see note on page 8) when the measured variable is at minimum measured range. Thus core motion thru full range is restricted to one side of MCT center. Refer to Figure 7.

Contacts and Retransmitters

One or two electrical contacts may be furnished with the Class J Receiver for alarms, controls, etc. In addition, retransmitters (slidewire or MCT type) may be installed in the Receiver. Slidewire retransmitters, however, cannot be used with Class JN Receivers.

These accessories are described in Instruction Section E12-42, Electrical Receiver for Type WM5□ Recorder or Indicator (Assembly and Components).

ADJUSTMENT AND CALIBRATION

Class J Receivers are furnished precalibrated by the Bailey Meter Company. Standard units are always calibrated for the range of voltage ratios transmitted from a standard MCT with a .265 inch stroke. When the actual core stroke is greater than .265, the range of voltage ratios is changed by a resistance bridge to equal the range of a .265 inch stroke. Thus, standard Receivers can be used in any circuit within their Class variation (JL or JN) without special calibration with the Transmitters. Nonstandard Receivers, however, which are calibrated for different core strokes are not interchangeable units unless recalibration is performed by a Bailey Service Engineer. Often a Receiver is calibrated for use with a specific Transmitter, in which case a special label identifying the Transmitter is placed on the side of the Receiver, below the identification plate and code label. Similarly, the serial number of the Receiver will be found on the Transmitter nameplate.

Calibration of Recording Pen or Indicating Pointer

Standard Class J Receivers that are received mounted in Type WM5□ Recorders or Indicators had their recording pens or pointers properly calibrated at the factory. Normally, no further calibration will be required. Calibration of a recording pen or pointer is necessary when the Receiver's position in the Recorder or Indicator case is changed, when a Receiver is added to a previously furnished Recorder or Indicator, etc. The recommended procedure is outlined in Instruction Section E12-42, Electrical Receiver for Type WM5□ Recorder or Indicator (Assembly and Components).

Amplifier Sensitivity Adjustment

This adjustment is described in Instruction Section E12-44, Solid-State A-C Amplifier Part No. 6618760-□.

MAINTENANCE

Information pertaining to the measuring circuit is given below. Maintenance instructions for the Recorder or Indicator, amplifier and Electrical Receivers in general, may be found in the Instruction Sections listed under "Cross References" on page 1.

Data

1. Winding Resistance Values of MCT:

Models K and H - primary -150 ohms; secondary -105 ohms each.

Model P - primary -175 ohms, secondary -220 ohms each. The above values are for a temperature of 80F.

2. Insulation Resistance of Movable Core Transformer Windings:

Greater than one megohm.

3. Movable Core Transformer Terminal Voltages and Voltage Ratios:

a. Terminals 1 and 2: In all standard Class J circuits, voltage between terminals 1 and 2 at Transmitter (or between black and white leads to MCT if there is no terminal board) should be about 45 volts.

b. Terminals 3, 4, 4A, and 5: Transmitter terminal voltages E_{34} (between terminals 3 and 4) and E_{45} (between 4 or 4A and 5), at any selected percentage of total core stroke, will depend upon Model movable core transformer that is used, Type of Class J circuit, and other factors. Usually they have values between 10 and 20 volts. However, absolute values of these terminal voltages are of little significance. Instead, make check explained below.

For all MCT's that are used with standard Class J Receivers, there is a standard relationship between voltage ratio E_{34}/E_{45} and per cent core stroke. Refer to Figure 7, and check voltage ratios as follows:

(1) Set core in transmitter at zero, 50%, or 100% of core stroke, as explained in Instruction Section for transmitter.

(2) Measure voltage between terminals 3 and 4 (E_{34}).

(3) Measure voltage between terminals 4 or 4A and 5 (E_{45}).

(4) Compute E_{34}/E_{45} and compare with Figure 7.

4. Changes in Calibration:

Balance point of Receiver may be affected by poor transmission line characteristics, such as excessive leakage between conductors and to ground, and high line resistance.

Operation Checks and Fault Corrections

If the system fails to operate or operates incorrectly when first installed, perform the following checks in the sequence given:

1. Check power supply to Recorder or Indicator (Figure 1).

Remove wiring channel cover from rear of Recorder or Indicator, and use an a-c voltmeter to check voltage across Recorder or Indicator power supply terminals in center of wiring channel. Reading should be 107-127 volts a-c.

2. Check power supply within Recorder or Indicator.

a. Connect an a-c voltmeter across terminals 1 and 2 of measuring terminal block. If no voltage is indicated, check Recorder or Indicator fuses, at power switch inside Recorder or Indicator case.

b. If power supply is a grounded system, voltage between terminal 1 and ground should be zero, and voltage between terminal 2 and ground should be 45 volts. If not check ground.

3. Check power supply at transmitter.

4. If reversing motor drives slidewire to either stop:

a. Power leads of transmitter may be reversed relative to Receiver. Connections 3, 4, and 5 may be crossed. Check all connecting lines between transmitter and Receiver for continuity and make sure they are not crossed. Make sure all external wiring is in accordance with specific external wiring diagram for system.

b. If Transmitter is a "suppressed range" transmitter, pressure or differential may be below operating range of system.

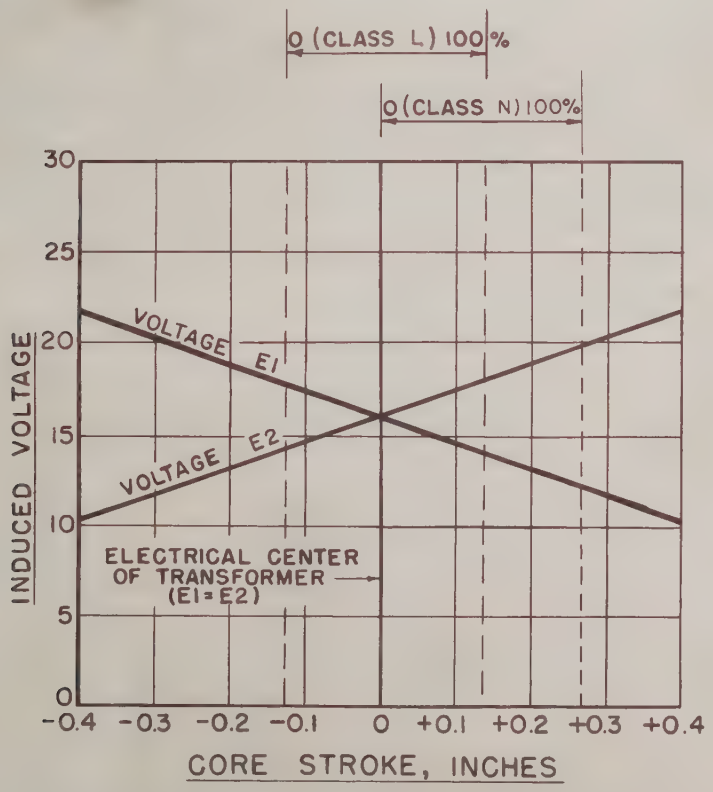


FIGURE 7 - Voltage Ratios for Class J Receivers

FAULT CORRECTION CHART FOR CLASS J RECEIVER

Fault	Probable Cause
1. Pen draws circle on the chart and does not respond to changes in the measured variable or pointer does not respond to changes in measured variable.	a. Transmitter core disconnected or locked in position. Check connecting linkage and drive mechanism to core. b. Amplifier failure. Amplifier input (pin Nos. 5 and 6 on amplifier socket) short circuited. Blown fuse in amplifier. c. Motor rotor or gear reduction unit frozen or jammed. Slidewire disc assembly should turn freely when power supply to Recorder is "off".
2. Erratic pen or pointer motion (not caused by rapidly changing variable).	a. Faulty slidewire contact. Slidewire brush must make positive contact over entire slidewire travel. Excessive tension will cause wear. Slidewire must be clean and free from all foreign matter. Do not use any abrasive material when cleaning. b. Loose connection in measuring circuit or flexible slidewire leads.
3. Pen or pointer drifts and does not follow measured variable.	a. MCT primary or both secondary connections open. b. Defective amplifier. Input leads to amplifier pin Nos. 5 and 6 not connected.
4. Pen or pointer is at top of scale and does not follow measured variable changes.	a. Open resistor "A", or open connection between terminal No. 3 and "A" resistor. b. Grounded connection No. 3, or broken flexible slidewire lead (100% end).
5. Pen or pointer is at bottom of scale and does not follow measured variable changes.	a. Open resistor "B", or open connection between terminal No. 5 and "B" resistor. b. Grounded connection No. 5, or broken flexible slidewire lead (0% end).
6. Insensitive or sluggish operation.	a. Defective amplifier or amplifier transistors. b. Excessive leakage between conductors and power circuits. Refer to external wiring recommendations. Resistance to ground (except lead No. 4) should be in excess of 250,000 ohms. c. Low power supply voltage. Normal voltage should be within 107-127 volts a-c.
7. Meter not in calibration.	a. Damaged or bent linkage, loose adjustment etc. b. Change in resistance of calibration spools or slidewire as a result of shorted turns or mechanical damage. c. Range increase - open parallel resistor across slidewire. d. Range decrease - open range resistor (R3) on Transmitter.

5. Checking input to Amplifier:

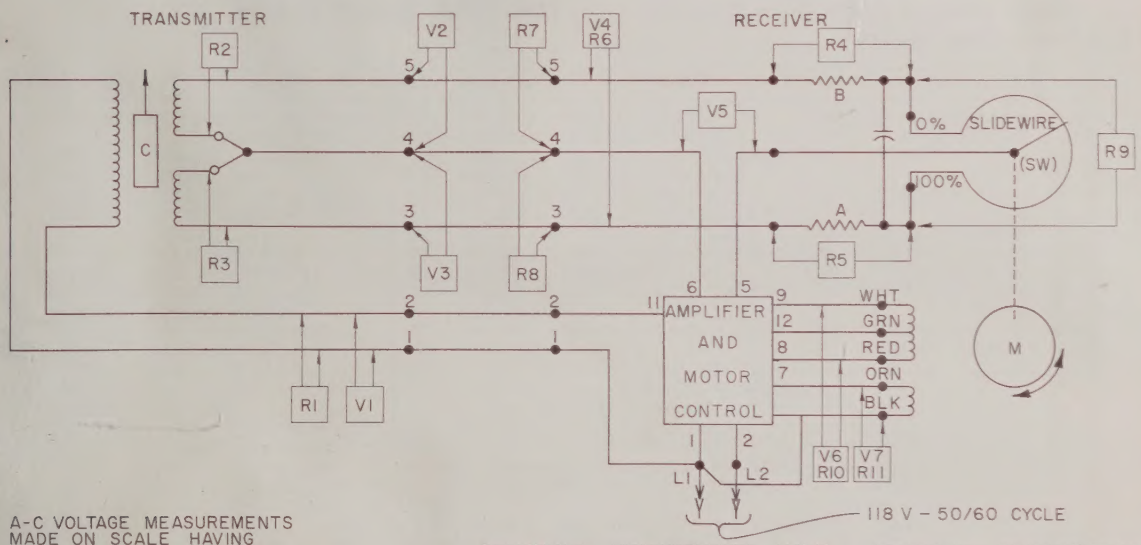
a. If a high resistance a-c voltmeter is available, input voltage, to amplifier may be measured. A twelve wire cable having suitable plugs at each end is required, since amplifier must be removed from Receiver to make this measurement. Whenever circuit is at balance, input voltage between pins 5 and 6 on amplifier plug should be zero. If for any reason, reversing motor should fail to reposition slidewire for a change in measured variable, input voltage to amplifier will increase in proportion to error in Recorder's or Indicator's reading.

b. If amplifier fails to reposition reversing motor, it is advisable to replace it with a spare amplifier while repairs are being made. Refer to Instruction Section E12-44

c. If reversing motor fails, or operates erratically, refer to Instruction Section E12-42. Electrical Receiver for Type WM5□ Recorder or Indicator (Assembly and Components).

6. Movable core transformer terminal voltages:

a. If above procedure indicates that Receiver is operating satisfactorily and that fault is in transmitter, terminal voltages may be measured at movable core transformer. See Figures 7 and 8. Allow reasonable tolerance for individual coil characteristics. If transmitting coil appears to be defective, do not attempt to repair it, but substitute a replacement coil.



A-C VOLTAGE MEASUREMENTS MADE ON SCALE HAVING 1000Ω/VOLT RESISTANCE OR GREATER – UNLESS AS NOTED.

APPROX. A-C VOLTAGE MEASUREMENTS

V1 – 45 V
*V2 – 11 V (C IN MID-POSITION)
*V3 – 11 V (C IN MID-POSITION)
V4 – 22 V
V5 – 0. (AT BALANCE-MEASURED WITH VTVM)
V6 – 5-3 V AT BALANCE; (10-20 V RUNNING)
V7 – 240 V AT BALANCE; 250 V RUNNING

*V2 = V3 WHEN CORE "C" IS IN CORRECT POSITION.
CORE "C" IN MIDDLE OF COIL FOR 0% – JN (TAPERED SLIDEWIRE)
CORE "C" IN MIDDLE OF COIL FOR 50% – JL (ROUND SLIDEWIRE)

RESISTANCE MEASUREMENTS MADE WITH CONNECTIONS 1,2,3,4, & 5 DISCONNECTED (VALUES APPROX. ±10%)

R1 – 150Ω
R2 – 105Ω
R3 – 105Ω
R4 – JL – 3140Ω; JN – 3580Ω EXACT
R5 – JL – 3140Ω; JN – 2815Ω VALUES
R6 – JL – 7080Ω; JN – 7195Ω
R7 – 4,500Ω ≈
R8 – 4,500Ω ≈
R9 – 800 (JL & JN)

NOTE: RESISTANCE BETWEEN CONDUCTORS AND CONDUCTORS TO GROUND MUST BE 250,000Ω OR MORE.

RESISTANCE MEASUREMENTS MADE WITH CONNECTION WHT, RED, ORN, GRN, & BLK (MOTOR) DISCONNECTED (VALUES APPROX. ± 10%) AT 25C

R10 – 23Ω
R11 – 850Ω

FIGURE 8 - Voltage and Resistance Measurements for Class J Circuit

REPLACEMENT PARTS

Spare Parts Kits

The applicable Spare Parts Kits referred to in Parts Drawing E12-111 (Figure 9) should be carried in stock. Specify the Spare Parts Kit part number to order a complete kit. Refer also to "Ordering Individual Parts" below.

Ordering Individual Parts

Parts Drawing E12-111 (Figure 9) shows parts that apply specifically to Class J Receivers. Refer to Instruction Section E12-42 for a drawing showing parts that are common to Electric Receivers of all circuit classes. Although Figure 9 normally will apply to the Receiver furnished, there may be individual differences in basic Receiver assemblies because of:

a. Design changes made since the printing of this Instruction Section.

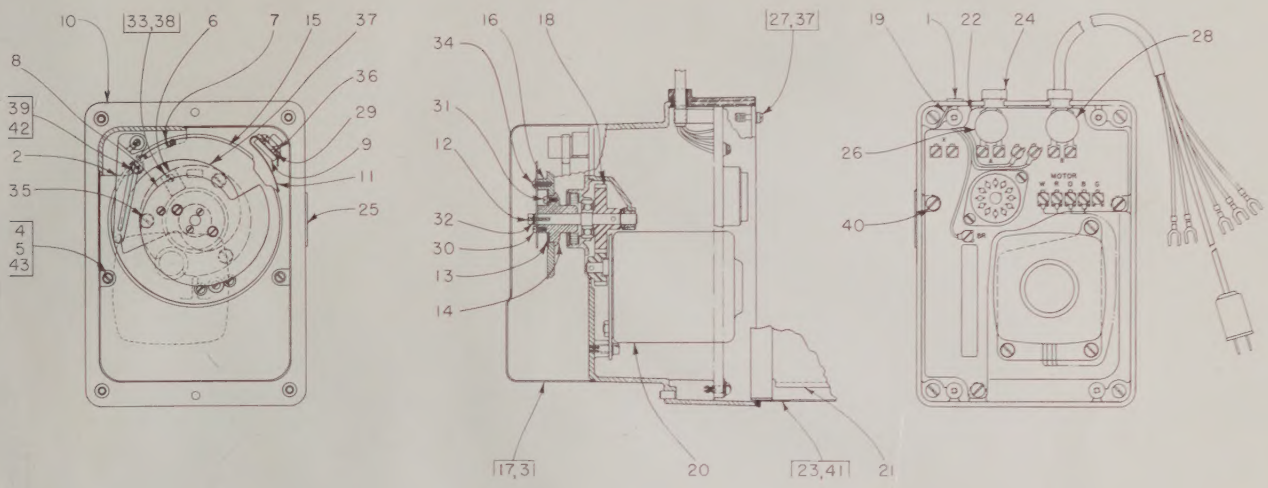
b. Special design of Receiver furnished to make it suitable for a special application.

Therefore, when ordering individual parts, assure correct replacements by specifying on the order:

1. Complete Class identification and code number of the Receiver for which parts are desired. The code number is shown on a label (Item 1 of Figure 9).

2. The Parts Drawing on which each part is illustrated. (The parts drawing number is given in the title for the Figure.)

Parts Drawings for Recorders, including pen assemblies are given in Instruction Section E12-3, Type KM55 or WM55 Recorder. For Amplifier parts, see Parts Drawing in Instruction Section E12-44.



ITEM	PART NO.	NAME
1	CODE LABEL	SPECIFY NO. WHEN ORDERING PARTS
2	668059-1	CAM FOLLOWER ARM ASSY
3	199287-1	LUBSAC ASSY
4	6614001-1	COVER SCREW, 2 REQD
5	6614002-1	COVER SUPPORT STUD, 2 REQD
6	68839-2	CAPILLARY CLIP
7	661483-1	CAM ARM SPRING
8	SEE TABLE	PRE-CUT CAM
9	666321-1	BRUSH SUPPORT
10	666431-1	MTG BRACKET ASSY
11	666366-1	BRUSH ASSEMBLY
12	663016-1	SPRING KEY
13	661501-1	DISC CLAMP
14	666326-1	DISC HUB
15	SEE TABLE	DISC ASSEMBLY
16	662153-1	DOWEL SLEEVE
17	666340-1	SLIDEWIRE COVER
18	666320-1	SHAFT GEAR ASSEMBLY
19	6612342-1	INSULATING PLATE
20	6618667-1	MOTOR ASSEMBLY
21	6618760-1	AMPLIFIER ASSEMBLY
22	SEE TABLE	WIRING ASSEMBLY
23	667206-1	AMPLIFIER COVER ASSY
24	35396-1	GROMMET
25	1961013-1	IDENT PLATE, 2 REQD
26	SEE TABLE	SPOOL
27	666719-1	MOUNTING SCR, 4 REQD
28	SEE TABLE	SPOOL
29	#3-48x3/16	PAN HD SLOT. SCR, 2 REQD
30	#3-48x1/4	PAN HD SLOT. SCR, 2 REQD
31	#3-48x1/4	FILL HD SCREW, 2 REQD
32	#3-48x3/16	HDLS CUP PT SET SCR
33	#4-40x3/16	PAN HD SLOTTED SCREW
34	#4-40x5/16	RD HD THD CUTTING SCR
35	#6-32x1/4	PAN HEAD SLOTTED EXT SEMS, 3 REQD
36	#6-32x5/16	PAN HEAD SLOTTED EXT SEMS, 2 REQD
37	#1108	SHKPF LK WASH., 4 REQD
38	#1204	SHAKEPROOF LK WASH.
39	#8-32x1/2	PAN HD SLOT. SCR, 3 REQD
40	#8-32x1/2	PAN HD SLOTTED EXT SEMS, 3 REQD
41	1/4-20x7/16	PAN HD SLOTTED SCR
42	#8 SAE	LOCKWASHER, 3 REQD
43	#10 SAE	LOCKWASHER, 2 REQD

CLASS	ITEM 8	ITEM 15	ITEM 22	ITEM 26	ITEM 28
JL	669572-1	661805-36	6618821-1	666364-11, 2 REQD	OMIT
JN	669572-2	661806-11	6618822-1	666436-9	666436-22

SPARE PARTS KIT		
SPARE PARTS KIT PT. NO. 250018-1		
QTY	ITEM	PART NO.
1	11	666366-1
1	20	6618667-1
2	FUSE*	194776-11001
AN AMPLIFIER, PT. NO. 6618760-1 MAY BE ORDERED IN A MORE COMPLETE STOCK OF SPARE PARTS IS DESIRED.		

*SHOWN ON PARTS DRAWING E12-67 IN INSTRUCTION SECTION E12-44

FIGURE 9 - Parts Drawing E12-111, Class JL and JN Receivers